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ABSTRACT

A study examined the semantic modifications students made to their texts in a structured revision task. Nineteen grade 6 students revised a book report they had previously written in class. Students: (1) added or deleted information from their texts in specific places identified by the experimenters through semantic frame analyses; (2) judged whether the original or revised sequence was better; and (3) justified their preference. The students overwhelmingly preferred their revisions (98% for addition and 84% for deletions). Results of semantic frame analyses indicated that students' additions improved the existing frame structure on 96% of the trials. There was 94% agreement between the students' preference for the revised sequence and the improved rating yielded from the frame structure analyses on addition trials. An agreement of 84% was reached on deletion trials. Holistic ratings of revisions also agreed with the ratings from the frame structure analyses. Students' justifications for their preference of original or revised text segments for both addition and deletion trials indicated awareness of semantic frame structure and of the discourse function of their revisions. These results reveal students' competence in semantic level revision. (Two figures and three tables of data are included.) (Author/KEH)

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STUDENTS' USE OF SEMANTIC STRUCTURE IN REVISING THEIR WRITING

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Running head: REVISING SEMANTIC STRUCTURE

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Abstract

This study examined the semantic modifications students make to their texts in a structured revision task. Nineteen grade six students revised a book-report they had previously written in class. Students a) added or deleted information from their texts in specific places identified by the experimenters through semantic frame analyses, b) judged whether the original or revised sequence was better, and c) justified their preference. The students overwhelmingly preferred their revisions (98% for addition and 84% for deletions). Results of semantic frame analyses indicated that students' additions improved the existing frame structure on 96% of the trials. There was 94% agreement between the students' preference for the revised sequence and the improved rating yielded from the frame structure analyses on addition trials. An agreement of 84% was reached on deletion trials. Holistic ratings of revisions also agreed with the ratings from the frame structure analyses. Students' justifications for their preference of original or revised text segments for both addition and deletion trials indicated awareness of semantic frame structure and of the discourse function of their revisions. These results reveal students' competence in semantic level revision. Implications of the findings for models of the revision process, instruction on revision, and assessment through the application of cognitive diagnosis are discussed.

STUDENTS' USE OF SEMANTIC STRUCTURE IN REVISING THEIR WRITING

This study examined the semantic modifications that elementary school students carry out when revising their written compositions in a structured revision task. The objectives of the study were: a) to assess whether additions or deletions achieved by students enhanced the semantic structures presented in their texts, b) to determine the relationship between students' self-assessments of the quality of each modification and the nature of the change in the semantic structure, and c) to examine the extent to which students' justifications for their self-assessments indicated access to the semantic structures of their texts.

Typically, students carry out few revisions in the compositions that they produce (see Fitzgerald, 1987, for a comprehensive review). From a cognitive viewpoint this is a puzzling finding: The production of a text can be characterized as the construction and coordination of a number of different levels of discourse representation, most notably semantic and surface structure levels, in order to fulfil a discourse function (Beaugrande, 1984; Frederiksen, Frederiksen & Bracewell, 1987; Flower & Hayes, 1984). Most students demonstrate that they can construct and coordinate these levels of representation by producing coherent texts during initial writing. If one can produce a coherent text as most students do during initial writing, then one should be able to modify it during revision.

The outcomes of efforts to increase and improve student revisions have been somewhat frustrating. Generally students respond to instruction by displaying better strategies (e.g., identifying places for revision); however, applications of strategies that result in higher quality texts have been less frequent (Fitzgerald & Markham, 1987; Scardamalia & Bereiter, 1987).

The limited success of these efforts could be due to a number of factors. First, at a most basic level students may lack skills in manipulating their semantic constructions; or they may be able to manipulate them, but not in a way that increases the quality of these structures. Second, at a more peripheral level they may lack skills in identifying parts of their texts that are in need of revision. Third, at a control level, they may lack skills in maintaining a sequence of operations that serves to search text, change it, and evaluate the changes in order to revise effectively. "Simulation-by intervention" studies suggest that

students are capable for example of diagnosing problems in text, and of modifying semantic structures; however, the dependent measures used have largely been taken from subjective ratings of the quality of student response or text change rather than direct measures of the discourse processes and structures involved (Scardamalia & Bereiter, 1986, 1987).

The purpose of this study was to examine one of the component processes involved in revision, namely semantic modification of a text. The theoretical basis for the analysis of semantic structure was taken from recent developments in discourse analysis, which allow the detailed coding of general semantic structures for a text (Frederiksen, 1986). Methods for the coding of these structures, labelled "frames", have been specified for descriptive, narrative, and procedural structures. We were interested in whether students could add or delete information to their compositions in a manner that would enhance the frame structures of the text. A structured revision task was designed in order to focus on semantic level revisions where these were warranted in the students' compositions.

Method

Subjects

Nineteen grade six students attending an elementary school in a middle-income, urban neighborhood participated in this study. These 11 girls and 8 boys all spoke English as their first language.

Materials

Each student wrote a book-report on a novel of their choice as part of the regular language arts curriculum. These book-reports were chosen because all contained a variety of descriptive, narrative, and procedural semantic structures.

Each book-report was transcribed verbatim, segmented into sentences, and printed in large type with triple spacing in preparation for the subsequent revision procedure. A representative example of one of these compositions is presented in Figure 1.

Insert Figure 1 about here

Pre-revision text and semantic analyses

Prior to the experimental sessions, the semantic structure of each composition was analyzed to identify sequences where the semantic structure could be: a) enhanced with additional information, or b) reduced by the deletion of redundant information. This analysis consisted of two phases: In the first phase a propositional analysis determined the detailed semantic structure of the compositions. In the second phase a frame analysis determined the higher-level semantic structure of the composition.

The propositional analysis followed Frederiksen (1975, 1986), and served to identify the states and events contained in the text as well as the temporal and dependency relations among them. This propositional analysis formed the basis for the analysis of the frame structure of each student's composition. According to Frederiksen (1986), a frame analysis proceeds from the propositional base to a frame structure of a given type. Three types of frame structure analyzed in this study were: narrative frames (representing the organization of sets of events in time and space), descriptive frames (consisting of states and events that are not time-specific) and procedural frames (consisting of conditions, operations, and goals or results). Each type of frame is defined by a semantic grammar that specifies the units making up the frame structure and the legal relationships among the units. For example, the narrative frame grammar defines two types of organization for events: a) episodes, which are sequences of events, and b) coordinate event sets, which are events having a time duration and which therefore can overlap with other events.

Places in the compositions where content might be added were identified on the basis of a lack of elaboration of the frame structure. For example, in Figure 1 sentences 5 and 6 constitute a minimal episode structure of two sequenced events (*finding* the cave, and the bear *throwing* them out) in the narrative frame. This part of the composition, then, was identified as a place where content might be added to enhance the narrative frame. Similar places in the compositions where descriptive and procedural frames were unelaborated were also identified. Across the 19 composition 46 places were identified where addition revisions could be made: 20 descriptive, 16 narrative, and 10 procedural.

Places in the compositions where information could be deleted were identified on the basis of redundant semantic information. For example, in the text presented in Figure 1 sentence 10 is redundant with sentence 1. Fourteen of the 19 compositions contained such

redundant sentences. Across these 14 compositions 19 places were identified where deletion revisions could be made; almost all contained descriptive frame information.

Revision Procedure

Task procedure

Each student met individually with an experimenter for an audio-taped revision session that lasted about thirty minutes. Compositions were given to students in the segmented, printed form described above. Each student read aloud his or her composition, and was asked if he or she wanted to make any changes in it. If a spontaneous change was made, the student was asked if the change improved the composition. The student was then asked to justify this decision.

The experimenter explained that the composition was printed in triple space so that the student could make some revisions to the composition by perhaps adding information or deleting some information. The experimenter emphasized that places for potential revision would be pointed out by the experimenter, but it was the student who had the final decision as to whether to make changes or not. The student was informed that the experimenter would ask if each change improved the composition or not. Lastly, the experimenter explained that the student would be asked to explain why the change either improved or did not improve the composition.

Modelling

Prior to the actual revision trials, the examiner modelled the revision procedure to familiarize the student with the task. Modelling served both to sensitize students to the result of ineffective revision and to help them see that it was acceptable to disagree with revisions suggested by the examiner.

The experimenter told the student that the composition had been read closely and places were information could be added or deleted had been found. On the first modelling trial the experimenter selected a sequence of three sentences, and asked the student to read the sequence, and proceeded to add irrelevant information to the sequence. The experimenter then asked the student to read the sequence with the information added and to decide if the addition improved the composition. The student was asked to justify this decision. On the second modelling trial the experimenter selected a sequence of three sentences, asked the student to read them aloud, and then deleted essential information

from the sequence. After the student reread the sequence with information deleted from it (as in the addition trial), the student was asked to decide whether the deletion improved the composition or not. The student was also asked to justify this decision. The experimenter summarized this modelling task to the students by saying that it was evident that making changes to a composition did not always improve the composition.

Student revision

For each composition there were from three to six revision trials. There were typically two addition trials and one deletion trial.The experimenter told the student that it would now be the student's turn to add and delete information to the composition and decide whether the original or changed version was better. The student was reminded that he/she would be asked to justify the preference for the original or changed version.

On addition trials the experimenter had the student read a pre-selected two or three sentence sequence, and pointed to a specific place in this sequence and asked the student, "Can you add information here in this space between the lines that would make your writing better?".

Following the addition of information, the examiner proceeded to the comparison phase. The student was asked to read the original sequence then read the revised sequence. The student was asked which sequence was preferred, the revised or the original. Finally, the student was asked to justify the preference, "Why do you think it is better? What parts do you think are better?"

Deletion trials were realized by the following procedure. As in the addition trial, the student read aloud a pre-selected sequence of three sentences. The examiner indicated a part of the sequence identified in the prior semantic analysis and asked the student if this part could be deleted. If the student agreed to delete the information, then the judgement and justification procedure described above was carried out.

Post-revision procedures

Semantic Analyses

The revisions carried out by students were analyzed to determine how the semantic structure of the compositions differed from the original text. The analyses of the revisions followed the procedure used for the semantic analyses of the original texts. That is, the revisions were analyzed at the propositional and frame levels.

The experimenters then compared the frame structures of the original and revised sequences in order to decide whether the revised or the original semantic structure was the better one. The criteria for this decision were the relationships of the semantic structure of the revised sequences with the original text. Thus, for the addition trials, a revision improved the text if it enhanced the frame structure. That is, the added content was coded in at least one of the frame analyses to be linked to the original frame structure. For deletion trials, improved text resulted when redundant frame structure was removed.

Students' justifications

The audiotapes were transcribed to obtain an exact account of students' justifications for their revision preferences. Students' justifications of their preference of original or revised text sequences were coded as either irrelevant, descriptive, narrative, procedural, or redundant justification statements. On addition trials, justifications were coded as irrelevant if they consisted of statements that were vague such as the revision was better because it sounded or looked better. Descriptive justification statements were statements which the students said they used because of the need to add information about the character or the need to describe how someone felt. Narrative justification statements were statements used in order to give more information about time and events. Procedural justification statements were statements used because of the need to add information about what the character wanted to happen (goals), how it happened (operations), why it happened (conditions) or about what happened (results). On deletion trials, justifications were coded as redundant justification statements if the students made statements indicating that the deleted information had already been mentioned or was too obvious. The correspondence between these types of justification statements and the type of frame information added or deleted from the text was examined for each revision trial.

Holistic evaluation of revisions

The results of students' revisions were evaluated subjectively by an independent rater, who judged whether each revision was better or worse than the original text.

Frame transitions for addition trials

The frame structure of the original sequence was compared to the frame structure of the revised sequence to investigate what types of frame structure the students used when adding information to their text.

Results

The independent variable in this study was the type of revision the student was directed to carry out, namely an addition or a deletion in the composition. The dependent variables included judgments of whether the revised or original text was better as obtained from a) the students, b) a comparison of the frame structures, and c) an independent reader. Dependent measures were also taken from students' justification of their judgements.

Pre-revision Text and Semantic Analyses

Segmentation

In each book-report there was a mean of 12 segments with a range from 7 to 20. Specific places that were determined to be candidates for the addition or deletion of information were presented to students in a sequence of two to three segments. Thus, at least the segment preceding the selected place for revision and the segment following it were presented to the students for each of the 65 revision trials.

Reliability of Semantic Analyses

Both the identification of places in the compositions for revision trials and the experimenter judgements of whether the original or revised sequences were better depended on the semantic frame analyses of the compositions. Since the use of the frame analyses for these purposes requires at least that the analysis procedures be reliable, one tenth of the trial sequences were analyzed independently for frame structure by two trained coders in order to assess reliability of the codings.

An example of a procedural frame coding is presented in Figure 2. The frame is

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Insert Figure 2 about here

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represented as a node/link structure. Each node is labelled indicating the constituent of the frame that is realized (e.g., CONDITION, OPERATOR). As well, the links are labelled with the relationship that occurs between constituents (e.g., COND for conditional relation). The notes that appear between asterisks are glosses for the text structures that motivate the coding of a node or link. In some instances these are lexical items taken from the surface structure, in others they are taken from the propositional analysis (*CF* stands for case relations, *WK* stands for world knowledge). The coding of frame structure was

found to be highly reliable (in excess of 80 per cent agreement) for each type of constituent and relation, with one exception. Codings of the relations based on world knowledge (*WK*) reached only 50 per cent agreement.

Results of Revision Procedures

Modelling

Student successfully demonstrated their understanding of the task during the pre-experimental session where the addition of irrelevant or the deletion of relevant information was modelled. Students were able to identify that the revisions did not improve their book-report and they could justify this decision.

Spontaneous revisions

When students were asked at the onset of the experimental session to try to improve any part of their text through the addition or deletion of information, they made minimal spontaneous revisions. Their revisions consisted of surface structure changes- spelling, punctuation, and word choice.

Student judgments of the revision

The students overwhelmingly preferred their revised texts (98 per cent for additions and 84 per cent for deletions). The modal length of their additions was one segment with the number of added segments ranging from one to four; the modal length of their deletions was also one segment with a more limited range of one to two.

Judgments of the revision based on semantic analyses

Results of the three frame analyses on addition trials showed that students' additions improved the existing frame structure on 96 per cent of the trials. The students' deletions of redundant information improved the frame structure on 100 per cent of the trails. (Redundant information had been identified by the experimenters in the pre-revision frame analysis, and thus the deletion of this information would automatically result in an improved frame structure rating.)

Comparison of students' judgments and semantic analyses

As seen in Table 1, on addition trials there was a 94 per cent agreement between students' preference for the revised sequence and the improved rating yielded from the comparison of original and revised frame structure. An example of an addition which was

judged by both the student and frame structure comparison to have improved the text is presented in Figure 2.

Insert Table 1 about here

On deletion trials there was an 84 per cent agreement between students' preference for the revised sequence and the improved rating yielded from the comparison of original and revised frame structure.

Insert Table 2 about here

Further investigation of the discrepancy between student preference and frame structure comparison revealed that students preferred to retain added information that was not identifed as enhancing the frame structure on 4 per cent of the trials (two trials). On 16 per cent of the deletion trials students preferred to retain material that did not enhance frame structure (three trials).

Independent rating and the comparison of the independent rating and the semantic analyses

On addition trials an independent reader who subjectively rated the revisions by blindly comparing original and revised sequences reached an 87 per cent agreement with student preference for revised sequences. There was 89 per cent agreement between the independent reader and the frame analyses comparison in preferring the revised sequences. On deletion trials an 83 per cent agreement was reached between independent reader preference and student preference for revised sequences. There was an 88 per cent agreement between the independent reader and the frame analyses comparison in preferring the revised sequence.

Students' justifications

Students' justifications of their preference of original or revised text segments for both addition and deletion trials were analyzed to assess their awareness of semantic frame structure. Results suggested that students had conscious access to the semantic structures

being revised. When students added information that constituted a procedural frame, 50 per cent of the time they justified their preference for the revised version by using a procedural justification statement such "it tells "why", or "it tells how" thus supplying information about goals and conditions, and operations. The remaining 50 per cent of the time the students made non-specific justification statements such as "it makes it better" or "gives it more meat on the bones" or "gives more information" or "makes it more interesting".

When students added information that constituted a narrative frame, 70 per cent of the time they justified that their revision was better by using a narrative justification statement such as "it gives more information about what they did" or "if they read the book, they will need to know what they did to survive" or "says some of the strange things that have been happening". When students added information that constituted a descriptive frame, 93 per cent of the time they used a descriptive justification statement to justify their preference for the revised text. They stated that the information improved their text because "gives more information" or "the reader has to know more". Other justifications made by the students concerning descriptive frame additions included the following: "it tells who, now you can understand it more clearly, before they didn't know what they are like, now the reader knows..., the reader would want to know, and tells what I mean by."

Students' justifications of why deletions improved their text were also analyzed. Results indicated that 69 per cent of their justifications were redundancy justification statements. Students most frequently stated that the deletions improved their text "because I already said that" or "it is pretty obvious that"...On the remaining trials students used irrelevant justification statements such as "it sounds better without it", or "you don't need it", thus revealing their lack of awareness of the the redundancy in their text.

Frame transitions for addition trials

The analysis of the type of frame information students added when revising revealed a substantial bias in favor of the addition of procedural information. The transition frequencies of type of frame in the original text versus type in the revised text is presented in Table 3. It can be seen that given either descriptive or procedural frames in the original

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Insert Table 3 about here

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sequence, students prefer to add procedural information. Given narrative information in the original sequence, students prefer to add procedural information almost 40 per cent of the time. This bias suggests that the students are sensitive to what interests the reader: Stories tend to be interesting for what they tell about characters' plans and interactions (Bruce, 1980), and it is this type of content that the procedural frame codes.

Discussion

The results of this study show that in a structured task grade 6 students can revise the semantic structure of their writing so as to improve its quality. The judgement and justification results reveal that they have at least some awareness of the semantic representation that they are manipulating. Taken together, these outcomes have implications for: a) psychological models of the knowledge and processes involved in revision, b) instructional procedures to improve writing and revision, and c) assessment of writing skills.

First, with respect to models of the revision process, the success of the students in manipulating the semantic structures suggests that much of the difficulty with revising lies at more peripheral levels of the process, in identifying promising places for revision and/or in control processes that regulate search, manipulation, and evaluation procedures in revision. A number of previous studies have demonstrated the importance of control processes for effective revision (e.g., Scardamalia & Bereiter, 1987). A model that included such control processes acting on the types of semantic structures investigated in the present study promises to provide a fairly complete account of the knowledge and skills involved in revision.

Second, these results suggest that instruction in revising should build on the students' competence and awareness, emphasizing training procedures that will allow students to analyze the specific semantic representations that they produce in their own writing. Modified in this way, more general training procedures for revising might at last produce reliable improvements in the quality of writing.

Third, with respect to assessment, these results suggest that techniques of cognitive diagnosis might be applicable to writing. In a recent discussion of criteria for the use

cognitive diagnosis Ohlsson and Langley (1986) specify three characteristics to be met by a potential domain of application:

1) The answer, or final goal-state, is not given in the problem statement (unlike, for example, proof-tasks or games).
2) The answer or outcome is one of a very large set of possible answers.
3) The answer or outcome should have internal structure (unlike, for example, simple yes-no responses to questions).

The domain that Ohlsson and Langely were considering was that of subtraction problems in arithmetic; and in fact cognitive diagnosis procedures have been most successfully applied in the domains of arithmetic and algebra problems. It can be seen readily, however, that the three criteria apply as well to the domain of writing.

The principal obstacle to the use of cognitive diagnosis in writing has been a lack of methods for determining the third characteristic, namely the internal structure of a composition. The techniques of discourse analysis used in this study, particularly the different types of frame analysis, begin to resolve this problem. Generally, the procedures used in this study were a variety of cognitive diagnosis: The internal structure of the compositions was examined to identify areas where strategic errors had been made. In the case of addition trials the error was one of not sufficiently elaborating a frame, in the case of deletion trials the error was one of repeating a frame structure.

The domain of writing is, however, sufficiently different from the domain of simple mathematics that major modifications will be required for the successful application of cognitive diagnosis in writing. A number of these can already be foreseen. The domains of arithmetic and algebra problems are highly structured, and it is this structure that allows one to classify answers as erroneous or incorrect. The domain of writing is much more variable in its structure; problematic structures in writing are not so much erroneous as they are infelicitous. Furthermore, errors in mathematics generally are context-free (e.g., failing to decrement when borrowing in subtaction is an error for all subtraction tasks). What is infelicitous in writing is highly bound by context. In the face of such variability the successful application of cognitive diagnosis might seem impossible. Against this possibility the results of the present study show that even relatively inexperienced writers have sufficient awareness of their task and the internal structure of their compositions to operate on a diagnosis.

An alternative way of treating the context issue is to say that the writer is carrying out a unique task with the composing of each text. An accurate cognitive diagnosis depends not only on an analysis of the internal structure of the text, it also depends on a knowledge of the task that the writer is attempting. For less experienced writers this knowledge can perhaps be approximated by an instructor (or researcher in the present case). But for more experienced writers it is likely that the task knowledge can only be provided by the author. In most cases then, cognitive diagnosis in writing will be carried out by the writer. A more accurate label for such activity might be *cognitive monitoring*.

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Authors Notes

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Figure Caption

Figure 1. Sample of student text prior to revision (Subject 5)

Segment #	Text
1	Warton's Christmas Eve Adventure written by Russell E. Erikson is an adventure story.
2	The novel deals with how a toad teaches a grumpy bear the true spirit of Christmas.
3	The three main characters are Warton, a toad, Monroe, a mole and an old bear.
4	Warton and Monroe were lost in the woods during a blizzard.
5	They found a cave with a bear hibernating in it.
6	The bear is very grumpy and throws them out of the cave.
7	A few of the chapters deal with how they live and help each other during the storm.
8	Those chapters were quite interesting.
9	During their adventure they find the true spirit of Christmas and teach it to the bear.
10	Russell E. Erickson's Warton's Christmas Eve Adventure is a adventure.

Figure Caption

Figure 2. Procedural frame coding of an addition trial (Subject 5)

Table 1

Correspondence on Addition Trials between Student Preference and Semantic Frame Analyses

		Semantic Analyses	
		Original	Revised
Student Preference	Original	0	1
	Revised	2	43

Table 2

Correspondence on Deletion Trials between Student Preference and Semantic Frame Analyses

		Semantic Analyses	
		Original	Revised
Student Preference	Original	0	3
	Revised	0	16

Table 3

Percentage of Transition in Semantic Frame Structure from Original Text to Revised Text for Addition Trials

		Revised Text		
		Descriptive	Narrative	Procedural
Original Text	Descriptive	40	5	55
	Narrative	18	44	38
	Procedural	30	20	50

Text

Segment 6 The bear is very grumpy and throws them out of the cave.

Addition They tried to explain that it was Christmas and he should be happy but he wouldn't listen.

Segment 7 A few of the chapters deal with how they live and help each other during the storm.

Procedural Frame